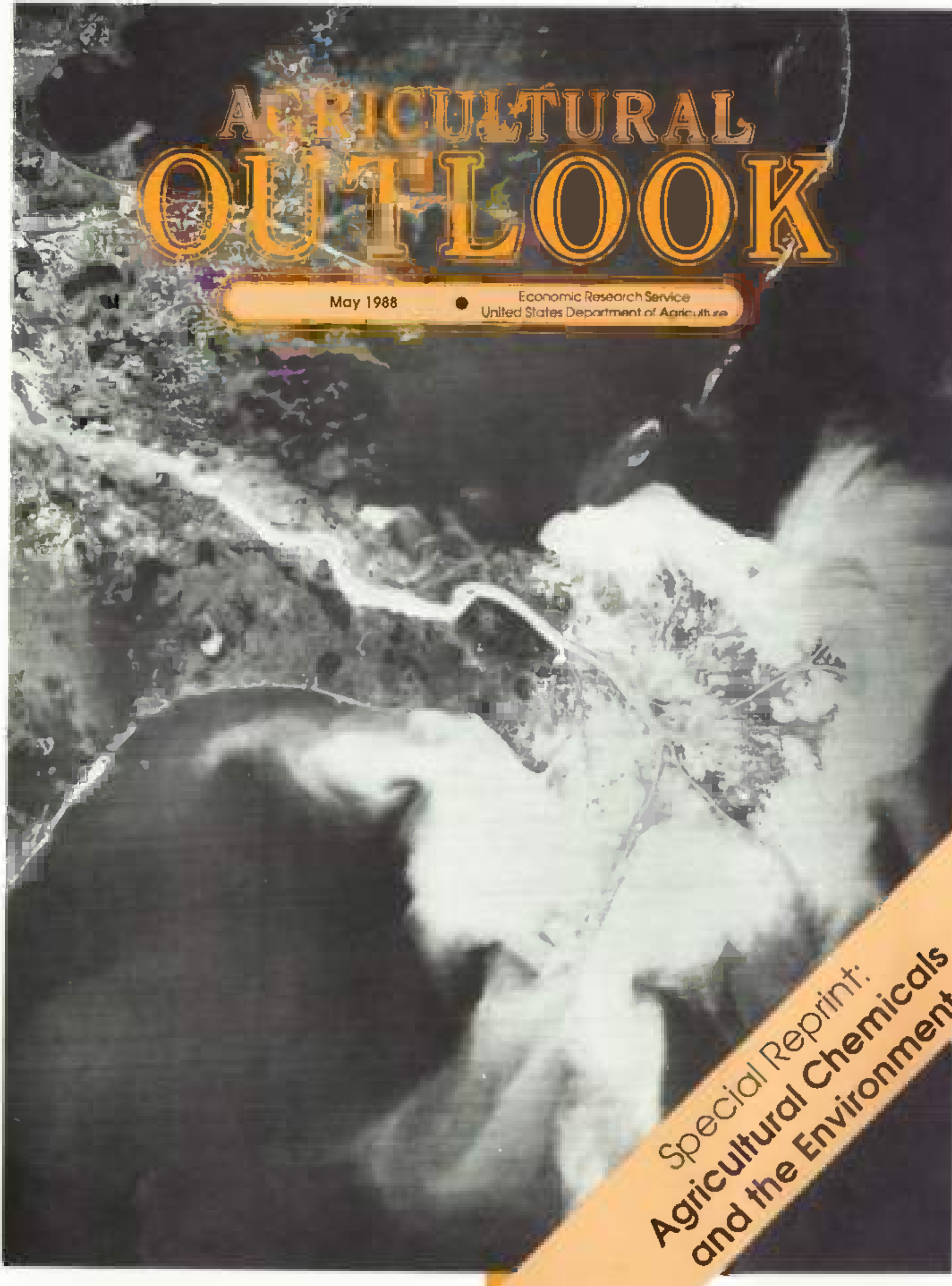
AGRICULTURAL OUTLOOK

May 1988 • Economic Research Service
United States Department of Agriculture



Special Reprint:
Agricultural Chemicals and the Environment

Contents

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Introduction

Natural resources in the United States have always been a major source of agricultural capacity to feed a growing domestic population and to produce exports. In earlier times, agricultural expansion depended on farmers' gaining access to additional natural resources. However, agricultural expansion in recent decades has come from using more capital and less labor, with little change in natural resource use.

Now a third possibility arises. What if we started to lose some of the resources we already have, through environmental degradation? This could sharply decrease the supply of farm products available each year and endanger human and animal health.

Several articles have recently appeared in *Agricultural Outlook* on the subject of farmers and pollution. Together, they present the extent of some pollution problems, review the Government's suggestions for regulation and research, and examine farmers' moves to alternatives to conventional farm practices.

More than 97 percent of rural drinking water in the United States comes from underground sources. Little is known about the extent of groundwater contamination from human activities, even though there are documented and suspected risks to human and animal health from exposure to contaminated groundwater.

Agricultural chemicals may contribute to groundwater contamination. When they do, contamination can persist for many years and cleanup costs can be prohibitive. About 800 of the nation's 3,000 counties have the potential for contamination by pesticides. They are located mainly along the Eastern Seaboard, Gulf Coast, and Upper Midwest. Another 300 with potential for nitrate contamination are located principally in the Great Plains and portions of the Northwest and Southwest. And, 300 more, located chiefly in the Corn Belt, Lake States, and Northeast, have potential for both types of contamination. More than 50 million people rely on groundwater for drinking in these 1,400 potentially affected counties.

Agricultural pollution also is a major problem in many of America's coastal waters. It results in sedimentation (which arises from soil erosion and runoff), nutrient enrichment (in which nitrogen and phosphorous are carried into coastal waters), and toxic contamination (from herbicides and insecticides).

Estuaries, the primary concern, are semi-enclosed bodies where fresh water from rivers and streams mixes with marine salt water. Estuaries are nurseries for many important recreational and commercial fish stocks, and they provide a habitat for a variety of wildlife as well as recreational opportunities. A study of 78 estuary systems found that agricultural runoff accounted for 24 percent of the nutrient loadings in the estuaries and 40 percent of the sedimentation.

The Water Quality Act passed by Congress in February 1987 expanded the regulation of pollutants of groundwater, surface water, and coastal waters, and authorized $400 million in Federal grants to reduce such pollution. The act extends emphasis beyond point sources of pollution such as industrial plants to nonpoint sources such as agricultural areas. Under the legislation, farmers whose practices are judged to contribute to nonpoint-source water pollution could be subject to State or local restrictions on land use and agricultural chemical use.

Besides new legislation, farmers will be affected by recently proposed changes in older environmental laws. A spreadsheet in this reprint reviews current and proposed resource and environmental programs affecting agriculture. The range and number of proposals suggest that, over the next several years, agricultural practices will undergo a major transition to meet environmental quality goals, with important effects on farm income and food costs.

But farmers are not waiting for legislation and regulation to force changes. Many are already trying and finding profitable alternatives to conventional agriculture that are environmentally neutral. These alternatives include reduced inputs, integrated pest management, different crop rotation, and different weed control methods. Through such alternatives, farmers seek to meet the twin goals of making profits and protecting the environment. *[Clark Edwards (202) 786-3313]*

Farm Chemicals and Groundwater Quality

The United States relies heavily on groundwater for domestic drinking, livestock, and irrigation. More than 97 percent of rural drinking water in the United States comes from underground sources, along with 55 percent of livestock water and 40 percent of irrigation water. In 1980, groundwater served 40 percent of the population using public water supplies.

Goundwater contamination, as the term is currently being used, occurs when agricultural chemicals applied to the soil surface leach to subsurface water.

Little is known about the extent of groundwater contamination from human activities, even though there are documented and suspected risks to human and animal health from exposure to contaminated groundwater. Concentrations of agricultural chemicals currently found in groundwater may not always exceed established health advisories.

Contamination can persist for many years and cleanup costs can be prohibitive. Interaction between surface water and groundwater can mean that in some areas aquifer contamination eventually pollutes streams, lakes, and estuaries.

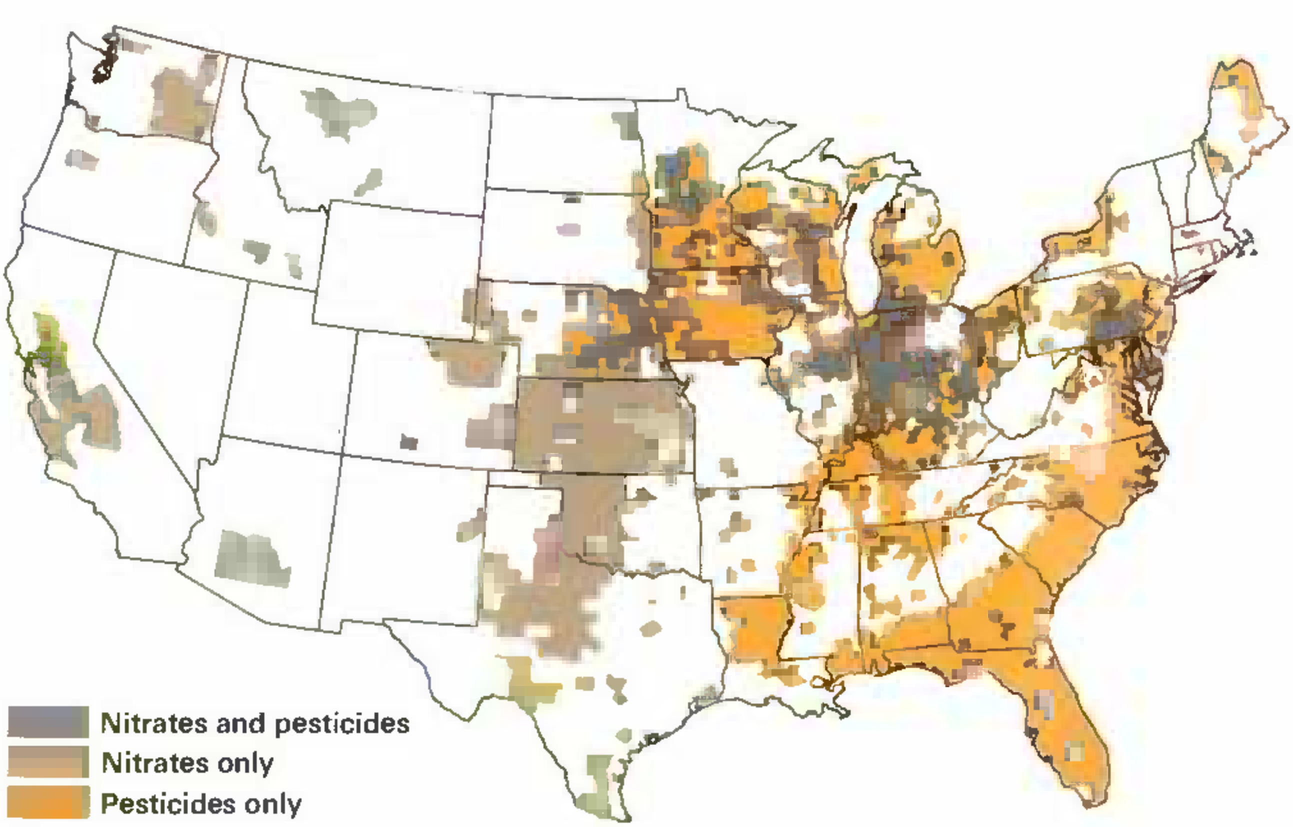
Agricultural chemicals may contribute to groundwater contamination. Programs and policies to control groundwater contamination from chemicals are being implemented by several States, including California, Iowa, and Wisconsin, and are under discussion in other States and Federally. But the lack of consistent, comprehensive data relating agricultural activities and groundwater contamination has hampered policy development.

Several trends over the past decades have increased the potential for agricultural contamination of groundwater. Use of inorganic nitrogen fertilizers, a major source of nitrate-nitrogen contamination, increased 150 percent between 1965 and 1984. Pesticide use nearly tripled between 1964 and 1984, mostly from increased use of herbicides, although acreage reductions resulting from the 1985 Food Security Act have led to reduction in total use of both pesticides and fertilizers.

Other trends—including concentrated livestock, dairy, and poultry operations; conservation tillage expansion; and increases in irrigated areas—may have raised the potential for contamination in some areas, although in the case of conservation tillage the relationship to groundwater contamination is not fully defined.

The extent of groundwater contamination depends on physical factors as well as land use and agricultural practices. Climate, hydrogeology, soil characteristics, aquifer recharge rates, water table depth, and characteristics of the aquifer and unsaturated zone are all important. The char-

Areas of Potential Groundwater Contamination from Farm Chemicals



acteristics of a potential pollutant itself, such as how easily it dissolves and how long it persists, also influence contamination.

Potential for Contamination In 46 Percent of U.S. Counties

ERS recently identified areas of potential groundwater contamination from agricultural uses of both pesticides and nitrogen fertilizers in the United States. Potential contamination was defined by combining county data on physical vulnerability with data on chemical use. The numbers and distribution of people using groundwater in areas of potential contamination were estimated. The data do not analyze local problems, but depict regional patterns.

About 46 percent of counties in the continental United States have the potential for contamination by pesticide and fertilizer residuals. There are 800 counties with potential pesticide contamination only. These counties are located mainly along the Eastern Seaboard, Gulf Coast, and upper Midwest.

Counties with potential nitrate contamination total about 300. These are found principally in the Great Plains and portions of the Northwest and Southwest. Only about 300 counties have potential for both pesticide and nitrate contamination. These are located chiefly in the Corn Belt, Lake States, and Northeast.

More than 50 million people rely on groundwater for their drinking water in the regions with potential for contamination. Of these people, about 19 million obtain their water from private wells, which are more vulnerable to contamination because they are shallower than public wells, and often not built as well. Areas with the most people relying on private wells are scattered through the South, Northeast, Midwest, and portions of the West.

More than 65 percent of the 50 million live in areas where only pesticide contamination is indicated. A majority of people using public groundwater supplies (68 percent) reside in areas with potential pesticide contamination.

Monitoring Private Wells Could Cost Over $2 Billion

Contaminated groundwater conld be costly to society and individuals, particularly from the standpoint of human health. The lack of available data on contamination occurrences and costs makes direct assessment difficult. One way to estimate what society must pay to reduce contamination risk is to determine what it would cost to avoid the risk. The first step in avoidance strategy is to monitor groundwater quality. If the information indicates that groundwater contamination is a problem. remedial action can then be taken.

The ERS estimates of initial monitoring costs for private wells in counties with potential for contaminated groundwater range from almost $1 billion to more than $2 billion, depending upon the assumptions used. The average or best estimate is about $1.4 billion for a one-time check. Pesticides, alone or in combination with nitrates, represent almost all of the monitoring costs because of the potentially larger geographical area and higher laboratory costs involved in pesticide checks. Rural residents who rely on private wells, particularly farmers, would incur a large portion of monitoring and detection costs.

Education, Research Important

Farmers are more affected by agricultural chemicals in groundwater than in surface water because their wells are likely to be close to the sources of contamination. Surveys suggest that farmers are concerned about groundwater contamination. Education programs for farmers therefore could play a major role in preventing or minimizing groundwater contamination. The success of education programs depends, in part, on research. Many research programs are just getting started.

Different strategies may be appropriate for dealing with nitrates than with pesticides. Monitoring for nitrates is relatively inexpensive, and the small number of private wells potentially affected may make a remedial program feasible. In contrast, monitoring costs for pesticides are so high that detection and remedial action may not be a workable strategy. Effective and economical prevention measures may be more efficient.

A protection strategy would be most effective if it targeted the most vulnerable regions. Not all regions where agricultural chemicals are being used are equally dependent upon groundwater, densely populated, or vulnerable to contamination, so regions could be assigned priority for groundwater protection. *[Linda K. Lee (202) 786-1444]*

Controlling Farm Pollution of Coastal Waters

Agricultural pollution is a major problem in many of America's coastal waters. It takes three forms: 1) sedimentation, which arises from soil erosion and runoff from cropland, 2) nutrient enrichment, in which nitrogen and phosphorous from fertilizers are transported by runoff and groundwater into coastal areas, and 3) contamination from toxic chemicals such as herbicides and insecticides.

Agricultural production creates nonpoint-source pollution, in contrast to point sources such as municipal waste treatment plants and industrial sources. Nonpoint-source pollution has received increasing attention since passage of the Water Quality Act of 1987. Section 319 of the act requires States to develop programs to control nonpoint-source pollution, and authorizes an initial appropriation of $400 million to do so.

Estuaries Become Pollutant Sinks

Of all coastal waters, estuaries are of primary concern. An estuary is a semi-enclosed body of water where fresh water from rivers and streams mixes with marine salt water. For most types of water pollution, especially chronic conditions such as excessive nutrients and pesticide concentrations, estuaries and bays suffer the most significant impacts. Estuaries serve as 'pollutant sinks,' where pollutants persist in water and sediment and are not completely flushed by water currents. Out in the open ocean, wind and currents dissipate most pollutants.

Estuaries serve several diverse biological and ecological functions. They are nurseries for many important recreational and commercial fish stocks; at least two-thirds of the commercial fish stocks harvested in the United States depend on estuarine waters at some point in their life cycle. Estuaries provide habitat for a wide variety of wildlife. Finally, estuaries provide swimming, fishing, hunting, and other recreational opportunities, often in close proximity to cities.

The physical consequences of the pollutants vary. While nutrients from farmland runoff can have some positive effect by contributing to the productivity of zooplankton and phytoplankton, excessive nutrients cause algae to bloom at abnormally high levels. This, in turn, depletes oxygen needed by other organisms. Large areas of Chesapeake Bay, for example, suffer low levels of dissolved oxygen during the summer. This can lead to declining fish harvests.

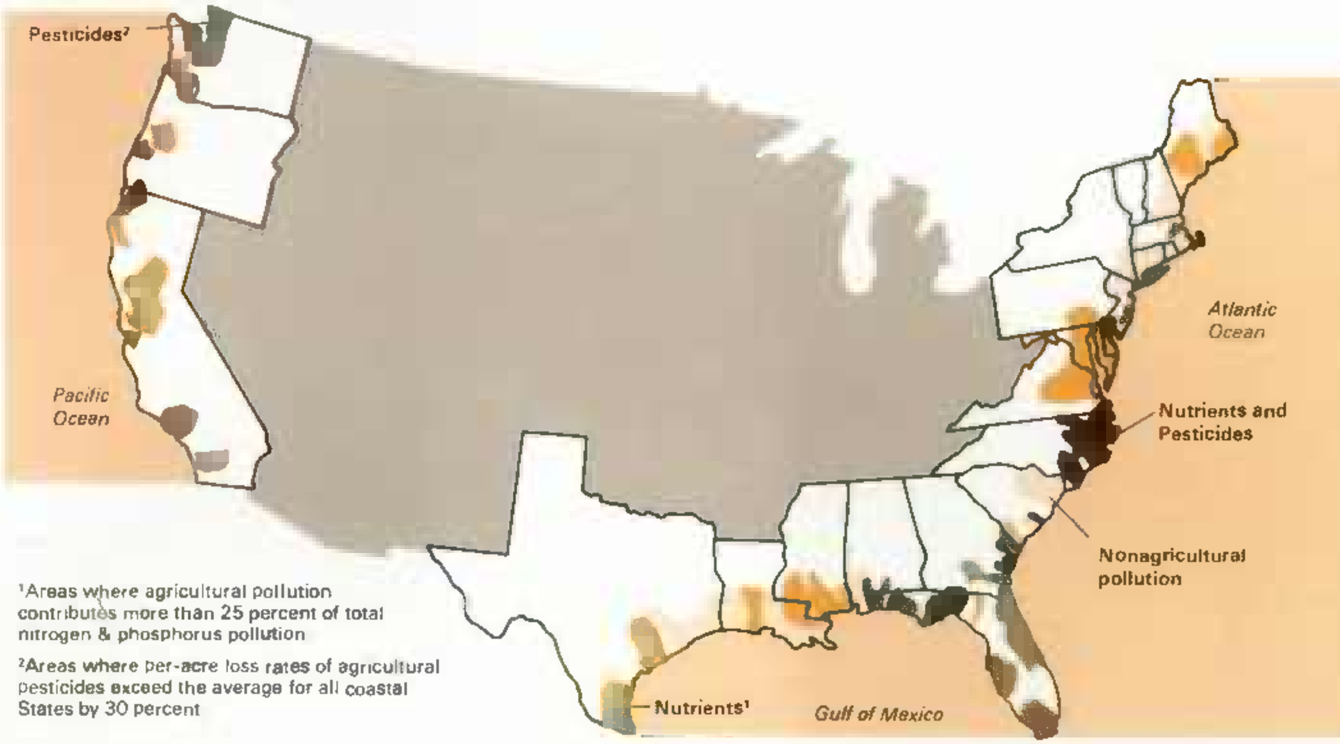
Silt deposits can damage spawning areas. Also, by increasing the turbidity of the waters, the deposits can block light needed by submerged aquatic vegetation, which is also an important component of spawning and nursery habitats.

Toxic deposits can kill fish and wildlife, and can indirectly harm organisms by contributing to diseases and increasing natural mortality rates. Pesticides cause a number of undesirable effects by passing through the food chain.

Annual Cost and Effectiveness of Soil Conservation Practices

	Estimated annual cost per acre	Reduction in field losses				
		Soil	Nitrogen in surface runoff	Nitrate leached out of the root zone	Total nitrogen	Total phosphorus
	$	Percent				
Permanent vegetative cover	150.00	95	90	-26*	38	95
Contour tillage & shorter slope length	10.00	44	35	-3	18	37
Winter cover crop & residual management	0-20.00	14	11	6	9	8
Reduced tillage & residue mgmt plus winter cover	10-20.00	30	50	-3	26	55
No-till & residue mgmt. plus winter cover	10-20.00	72	51	19	37	60
Sod waterway system	8.25	62	44	-3	23	49
Terrace system	66.25	70	50	-4	26	38
Diversion system w/20-foot sod filter strip	12.15	41	30	-2	16	39
Reduced tillage plus sod waterway	18.25	81	72	-5	38	76
Reduced tillage, along w/field contour, residue mgmt., sod water ways, terrace	94.50	90	69	-6	36	79
No-till planting along the field contour w/ residue mgmt.	20.00	84	68	15	44	75

*Minus sign before figure indicates increased nitrate contamination. Estimates are for continuously cropped land planted to corn, silt loam soil, 5-percent slope, daily spreading of manure at 20/tons/acre/year, Lancaster County, PA.



Toxic compounds in lower order organisms and sediment can be concentrated as they are eaten by higher level fish and wildlife. High concentrations of pesticides have been found in some commercial fish and shellfish, and have harmed several waterfowl species.

Of course, agriculture is only one source of coastal water pollution. Others include urban runoff, municipal waste treatment plants, and industrial sources. ERS has recently begun to identify the scope and significance of agricultural contributions to coastal water pollution, and to measure the extent to which controlling this type of pollution could improve water quality in coastal regions.

Data as of 1982 were obtained on quantities of surface water pollutants (called "loadings") from both point and nonpoint sources in 23 coastal States. Seventy-eight estuarine systems were selected for further study.

Data on coastal land use, agricultural activity, and pollution loadings from point and nonpoint sources were examined by estuarine drainage area, that is, the upland area which drains into a given estuary. For the 78 estuarine systems considered, agricultural runoff supplied, on average, 24 percent of the total nutrient loadings and 40 percent of total sediment.

The data were further analyzed to identify those estuarine systems where agricultural sources account for major portions of total pollutant loadings. Estimates of pollutant loadings were used to assess the importance of agricultural nonpoint-source pollution in coastal water.

For example, while data on concentrations of pesticides in coastal waters are not available, coastal areas where per-acre losses of chemicals in runoff are relatively high are likely to have pesticide contamination problems in estuarine waters. Estuaries were identified according to three criteria: 1) those with above-average shares of total nutrient loadings supplied by agriculture sources, 2) those with drainage areas with high per-acre pesticide losses to surface water (defined as exceeding the average for all coastal States by 30 percent), and 3) those with both high agricultural nutrient inflows and high pesticide losses.

Of the 78 estuaries, agriculture contributed more than one-fourth of total nutrient loadings in 22. High rates of pesticide losses to surface waters were found in 21 systems. Fifteen estuarine systems showed both significant agricultural nutrient loadings and high pesticide losses.

Soil Conservation Is Critical Factor

One critical factor in identifying potential areas for nonpoint pollution control programs is the extent to which soil conservation practices are used to reduce erosion and runoff. Only 14 percent of all agricultural land in the estuarine systems examined had some form of conservation tillage or nutrient-management program in place in 1982.

While several important estuarine systems showed high levels of conservation practice (such as Chesapeake, Galveston, and San Francisco bays), the potential exists for further conservation to reduce erosion and nonpoint-source agricultural loadings in many coastal water systems.

The agricultural sector will likely be asked to help reduce further the pollution of coastal waters. Previous efforts have largely been targeted at controlling point sources. In many instances, further reductions in point-source loadings are becoming too costly, and more emphasis is being placed on controlling nonpoint sources, including agricultural runoff and soil erosion. The Water Quality Act requires State and Federal authorities to develop management plans that implement conservation practices to reduce nutrient, sediment, and pesticide pollution from cropland.

Many options are available to control agricultural nonpoint-source pollution, including structural measures (terracing or sod waterway systems) and nonstructural (conservation tillage and no-till practices, nutrient management, and pesticide management).

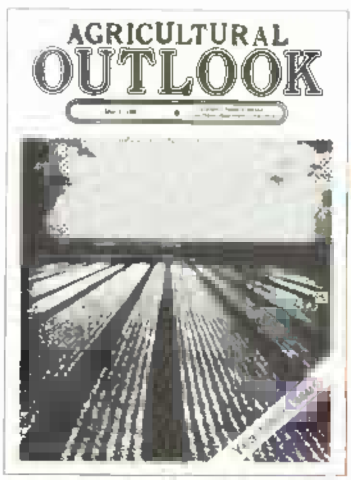
ERS recently completed a study of the cost effectiveness of several management options for soil conservation. Eleven different combinations of conservation strategies were analyzed for the per-acre cost and the expected reductions in soil erosion, nutrient loss to surface water, and nitrate loss to groundwater. The study area was a Rural Clean Water Project in Lancaster County, Pennsylvania.

Reduced Tillage & Residue Management Are Most Cost Effective

In the study, permanent vegetative cover was the most effective means of controlling nonpoint-source pollution from cropland, but it also could be the most expensive. Thus, the unit cost of pollution reduction was higher than for other practices. Some of the more cost-effective management schemes were nonstructural.

However, Federal cost-sharing pays up to 75 percent of the costs of structural measures or 50 percent of the cost of permanent vegetative cover. This may encourage farmers to adopt structural approaches such as terraces and sod waterways rather than alternative tillage methods, for which financial assistance is not generally available.

Future public expenditures for control of nonpoint-source pollution could provide cost sharing for nonstructural solutions to achieve greater reductions in water pollution, and could be targeted at those areas where the potential for improvement in water quality is greatest. This would ensure the maximum effectiveness in reducing pollution while minimizing the burden on taxpayers and farmers. *[Stephen Crutchfield (202) 786-1444]*



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Water Quality Act Will Affect U.S. Farming

The Water Quality Act (WQA), passed by Congress last February, expanded the categories of pollutants regulated, including nonpoint-source pollution; increased the scope of water quality regulations to include groundwater; and authorized the appropriation of $400 million in Federal grants to reduce nonpoint-source pollution.

The Water Quality Act will have an impact on agricultural practices because nonpoint-source pollution is a byproduct of agricultural production. Runoff from agricultural lands contains sediment, nitrogen, phosphorous, pesticides, and other substances that constitute a significant portion of nonpoint-source pollution entering the nation's waterways and estuaries.

Agricultural lands are responsible for about a third of the estimated $6 billion in offsite damage caused by soil erosion. Leaching of nutrients and pesticides from cropland into groundwater is a problem in some rural areas. The level of nonpoint-source pollution from agricultural land can be reduced by altering production practices.

The WQA differs from prior legislation by requiring States to consider both point- and nonpoint-source pollution in water quality programs. States are required to conduct an inventory of navigable waters and identify sources of water quality degradation. They are to develop management plans which identify best management practices and enable each State to meet water quality standards of the Environmental Protection Agency.

Because no State has yet completed an inventory of its navigable watersheds and submitted a management program for approval, the extent to which agriculture will be affected by the WQA is uncertain. Most States are considering the use of voluntary compliance measures, combined with training and education programs, demonstration projects, and water quality monitoring.

A few States are examining a regulatory approach in watersheds identified as having persistent and severe pollution. The most frequently mentioned target for both the voluntary and regulatory approaches is limiting soil erosion on agricultural lands to *T*, the level of erosion at which a soil can maintain its productive capacity indefinitely.

The Food Security Act of 1985 contained conservation provisions that complement the WQA. Among these provisions were the Conservation Reserve Program (CRP) and the Conservation Compliance Provision. The WQA and the conservation provisions in the 1985 Farm Act will improve water quality by changing agricultural practices to reduce soil erosion. In addition, the WQA will require agricultural producers to undertake measures to control offsite movement of agricultural chemicals and livestock waste.

How will the WQA and the conservation provisions of the Food Security Act affect agriculture? Some of the effects are as follows:

- We can identify which lands may require treatment in order to meet nonpoint-source targets. (See map in *Agricultural Outlook*, April 1987, page 28.) On much of this land, erosion can be reduced to target levels by altering tillage practices. But, on other sites the crop rotations must be shifted from more erosive crops such as corn and soybeans to less erosive rotations such as hay and pasture.

- Forty to 45 million acres of cropland are expected to enter the Conservation Reserve Program, and an additional 9 million are not expected to remain in production because they require extensive conservation measures in order to meet the soil erosion targets. Idling this land will cut agricultural production.

  In addition, the changes in production practices in areas with erosion levels greater than *T* will alter crop yields and regional production patterns. In areas where crop rotations must change, or more expensive production practices implemented, net income and agricultural production could be reduced. In the long run, though, reduced erosion will preserve cropland productive capacity.

- The WQA will reduce agricultural chemical use. Some observers are suggesting user taxes on agricultural chemicals. Iowa has imposed a tax (75 cents per ton) on nitrogen. Changes in chemical use will alter agricultural yields.

- The soil tolerance target mentioned by many States is more stringent than the standard set by the Conservation Compliance Provision. The WQA sets a goal that agricultural land contributing to nonpoint-source pollution be held at an erosion level less than the tolerance, not just highly erodible land participating in commodity programs.

- Seepage from manure storage facilities contains large quantities of bacteria, nitrogen, and phosphorous which can contaminate both surface waterways and groundwater. Livestock operations with more than 300 animal units are defined as point sources which require discharge permits if they are adjacent to waterways. However, the potential for groundwater contamination was not considered when the discharge permits were issued.

Much of the nation's livestock production is on farms with less than 300 animal units, and runoff and groundwater contamination from these smaller operations is considered nonpoint-source pollution in the WQA. Effluent from these smaller operations constitutes a significant problem and will be affected by the WQA. Management of animal wastes in a manner that does not degrade surface or groundwater increases the cost of livestock production.

Agriculture contributes only one-third of the total U.S. nonpoint-source pollution. The nonagricultural sources of nonpoint-source pollution need to be identified lest agriculture, as a large and visible source, is called upon to bear a disproportionate share of the burden. *[Bengt Hyberg (202) 786-1404]*

A Survey of Resource And Environmental Policies Affecting Agriculture

Agriculture can be profoundly affected by national policies or programs that do not directly concern farming. Witness the effect of easier monetary policy in reducing interest rates, lessening the value of the dollar, and consequently increasing the competitiveness of U.S. agricultural exports. In coming years, resource and environmental policies will increasingly affect the profitability, structure, and long-term sustainability of farming.

Natural resource policies affect the use, value, and quality of the ingredients of agricultural production—land, soil, and water. Environmental policies are directed toward broader concerns, including protection of human health, can affect agriculture when production inputs (fertilizers and pesticides, for example) or the byproducts of production (animal waste or soil runoff) are pollutants or health hazards.

The 1985 Food Security Act contains several new, wide-ranging programs targeted at reducing soil erosion on agricultural lands. However, the majority of resource and environmental programs affecting agriculture are legislated outside of farm policy and implemented by agencies other than USDA.

For instance, many farm and ranch enterprises in the Western United States have evolved around low-cost Federal irrigation water and public grazing lands. An increase in water prices or grazing fees could cause severe economic losses by farmers and ranchers who depend on those resources.

When a pesticide is banned because it poses health or environmental risks, the cost of protecting crops goes up unless a same-cost, equally effective material is available. Some of the increased cost may be passed on to consumers, but the rest is absorbed by farmers.

Fertilizer and pesticide contamination of groundwater has led to numerous policy proposals affecting agriculture. The Water Quality Act of 1987 uses State incentives or legislation to reduce pollution due to agriculture. Several States have passed laws restricting land use near major water supplies.

Restricting land use to improve environmental quality can restrict the income of some farmers. For example, prohibiting pesticide or fertilizer use on cropland near vulnerable water systems could reduce yields. Although this and other proposals can indirectly aid the farm sector by reducing surpluses and supporting commodity prices, individual farmers pay the short-term price.

The following spreadsheet reviews selected current and proposed resource and environmental programs affecting agriculture. The range and number of proposals suggest that, over the next several years, agricultural practices will undergo a major transition to meet environmental quality goals, with important effects on farm income and food costs. *[Kitty Reichelderfer (202) 786-1448]*

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Resource & Environmental Policies Affecting Agriculture

Policy/proposal	Key provisions	Comments
Land use		
Swampbuster provision		
Current law	Denies price support & deficiency payments, farm storage facility loans, crop insurance, disaster payments, & FmHA-insured loans to any person producing an agricultural commodity on wetland converted since December 23, 1985.	Reduces incentives to convert wetlands to farmland. There are 60 million acres of upland wetlands in private ownership. Between 5 & 16 million acres may be convertible.
Proposed changes		
Durenberger (S. 733)	Exempts wetlands used to produce an agricultural commodity in at least 3 years between 1980 & 1985.	In 1982, there were 4.1 million acres of wetlands that were sufficiently dry for crop production.
Stangeland (H.R. 2223)	Makes wetlands, converted wetlands, & land currently eligible for Water Bank Program eligible for Conservation Reserve Program (CRP).	Provides benefit program complementary to Swampbuster sanction for wetlands, analogous to CRP for highly erodible lands.
Bumpers (S. 1775)	Transfers wetlands or other marginal or environmentally sensitive land in FmHA's inventory to Federal or State wildlife authorities.	Prevents wetlands & other physically marginal land from returning to agricultural production.
Softwood timber provision		
Current law	Allows delinquent farm loans to be rescheduled by planting farmland to softwood timber & pledging future revenues to repayment of loan.	Increases U.S. timber supply while aiding debt-burdened farmers. Program limited to 50,000 acres nationally & open only to farmers who own commercial forestland & have debts less than $1,000/acre.
Grazing fees on public rangelands		
Current law	Permits livestock producers to rent public lands from Federal Government for grazing. Establishes formula for determining grazing fee rates. Fees restricted to minimum of $1.35 per animal unit month (AUM). Annual increase or decrease in fees limited to 25% of previous year's fee.	In 1982, about 27,000 producers grazed livestock on public rangelands, comprising about 7% of Western livestock producers & 2% of nation's producers. Area of public range where use permitted represented 10% of nation's total rangeland forage but provided only 2% of total feed consumed by livestock.
Proposed changes *Darden (H.R. 1481) & Synar (H.R. 2621)*	Revises grazing fee formula to establish market-based fees for each of six pricing areas. Fee adjustments, plus or minus, would be limited by both bills—to 33.3% of previous grazing year's fee by Darden & 25% for the first 3 grazing years after 1987 by Synar. After 3 years there would be no limit. Synar would amend statutes concerning use of appropriated range improvement funds & grazing fee revenues, specifying expenditures for riparian habitat improvement.	Based on 1985 values, proposed formula would produce grazing fees of $4.82-$8.21 per AUM depending on pricing area, compared with present $1.35 per AUM. Fees under Synar bill would not increase as rapidly as under Darden bill for first 3 years. Of grazing fees collected, 50% would go into a fund, one-half of which could be made available in the district, region, or national forest from which it was derived. Other 25% would be used for on-ground range improvements, irrespective of where fees originated. Synar would require that 25% of on-ground improvements be riparian habitat.

Policy/proposal	Key provisions	Comments
Land use, *continued*		
Marlenee (H.R. 1899)	Makes permanent current formula for computing Federal grazing fees Would eliminate present minimum of $1.35 per AUM, but would retain annual change limit of not more than plus or minus 25% of previous year's fee	
Soil conservation		
Conservation Reserve Program		
Current law	Pays farmers annual rental payments & half the cost of establishing permanent cover for retiring highly erodible cropland for 10 years. Goal is 45 million acres.	Over 100 million acres are eligible for enrollment in program. Current enrollment of 23 million acres has reduced annual erosion by 480 million tons. New USDA rules expand eligibility to include filter strips & less erodible cropland if it is planted to trees. Stronger emphasis is placed on water quality & achieving the desired level (12.5%) of tree planting.
Proposed changes		
Hatcher (H.R. 3357) *Nunn (S. 2937)*	Expands program from 45 to 65 million acres, to include farmers with highly erodible cropland that is irrigated with groundwater or known to cause water quality problems.	Including cropland irrigated with groundwater or causing water quality problems may increase eligibility by 10-15 million acres.
Dole (S. 2045)	Establishes a new reserve to idle 5-20 million acres identified as potentially threatening to the environment. Environmental provisions cover groundwater & overall water quality, set restrictions based on pesticide use, soil damage, soil salinity, & related problems.	Dole bill would further place a limit on the total amount of farmland idled under all commodity & conservation programs, & provide permanent spending authority for CRP & an expanded environmental conservation reserve from CCC funds. Both Nunn/Hatcher & Dole proposals would allow USDA to increase monetary incentives through bonus payments, additional payments for permanent base retirement, & using CRP acreage to meet set-aside requirements.
Sodbuster provision		
Current law	Denies price support & deficiency payments, farm storage facility loans, crop insurance, disaster payments, & FmHA-insured loans to any person producing an agricultural commodity on highly erodible land converted since December 23, 1985, unless an approved conservation plan is adopted & implemented. "Highly erodible" is defined in regulations as an erosion index greater than or equal to 8.	Affects 227 million acres with some potential for conversion. Two-thirds of this land is currently pasture & rangeland. Erosion on sodbusted land must be reduced to the soil tolerance level (T), which averages 5 tons of erosion per acre per year.
Conservation compliance provision		
Current law	Requires farmers with highly erodible cropland to begin implementation of a conservation plan by 1990 & complete it by 1995 to retain eligibility for the Government programs listed under Sodbuster.	Could affect production possibilities & costs on up to 65 million acres depending upon the level of enrollment in CRP & the level of treatment required. As many as 10 million acres could drop out of production or out of commodity programs.

Policy/proposal	Key provisions	Comments
Irrigation water		
Reclamation Project Act of 1939		
Current law	For irrigation water projects constructed by the U.S. Bureau of Reclamation, Secretary of Interior may consider other factors than construction cost when setting terms of repayment contracts.	Subsidizes Western irrigation water development. Farmers pay less than full cost for water developed by Bureau of Reclamation.
Proposed changes		
Gejdenson (H.R. 1443)	Requires Secretary of Interior to charge full cost for irrigation water delivered from any project constructed by the Bureau of Reclamation when the water is used for production of a surplus crop.	Reduces potential for the same individual to receive a double subsidy: both irrigation water cost & crop price supports. Likely would reduce use of water from endangered Western aquifers.
Stark (H.R. 3384)	Defines individual's taxable gross income to include amount equal to subsidy of irrigation water from Bureau of Reclamation projects.	Garners part of Federal irrigation subsidy for Federal Treasury. Likely would reduce use of water from endangered Western aquifers.
Water quality (general)		
1987 Water Quality Act		
Current law (nonpoint source pollution provisions—NPSP)	Requires each State to identify for EPA, by August 1988, navigable waters which cannot regain or maintain applicable water quality standards without reducing NPSP. Instructs States to identify categories of NPSP contributing to pollution of degraded waterways, & to identify best management practices to reduce NPSP to maximum practical extent & to improve quality of these waterways.	Farmers whose practices are judged to contribute to nonpoint source water pollution problems could be subject to State or local restrictions on land use & agricultural chemical use. Impact on farmers will vary by State.
Groundwater protection		
Proposals		
Gejdenson (H.R. 791, with Foley amendments from H.R. 3676) *Durenberger (S. 513)* *Scheuer (H.R. 2253)* *Burdick (S. 1105)* *Heinz (S. 1992)*	Directs various Federal agencies, including Dept. of Interior, Agriculture, & EPA, to assess groundwater quality & establish programs for groundwater quality research & demonstration of groundwater protection methods.	Increases Federal responsibility for groundwater pollution from agriculture by allocation of research & extension funds.
Miller (H.R. 2320)	Secretary of Interior publishes criteria for assessing adequacy of groundwater protection & management programs by States. Within 3 years after criteria are published, no Federal official or agent may expend funds for reclamation projects or execute reclamation contracts within States identified by Secretary as having inadequate groundwater programs.	If reclamation contracts for water & power are not executed, then agricultural, municipal, & industrial users could experience a reduction in utility services.

Policy/proposal	Key provisions	Comments
Groundwater protection, *continued*		
Karnes (S. 1696) *Burdick (S. 1767)* *Stangeland (H.R. 3069)*	Establishes a Best Management Practices Task Force for agricultural nitrogen, to review status of current information & develop & demonstrate best management practices, such as timing nitrogen fertilizer applications to reduce amount applied.	Protects environment & public health by reducing levels of agricultural nitrogen in groundwater & surface water.
Energy from biomass		
Current laws	When 10% ethanol or more is blended with gasoline, blenders qualify for 6-cent-per-gallon exemption from current 9-cent excise tax on gasoline. Minimum 10% blend requirement is an effective subsidy of 60 cents per gallon of ethanol. As alternative, blenders may take income tax credit equal to 60 cents per gallon of ethanol. Subsidy expires on September 30, 1993	Encourages production of ethanol to reduce U.S. reliance on imported oil.
Proposed changes		
Dole (S. 1598) *Grassley (S. Res. 92)* *Durbin (H. Res. 74)*	Proposals would either extend excise tax exemption through 2000 or reject any recommendation to eliminate the current exemption.	
Nagle (H.R. 3172) *Daub (H.R. 2949)* *Exon (S. 781)* *Exon (S. 1232)*	Makes USDA's CCC grain available to ethanol producers. Typically, 100 million bushels of grain would be provided for start-up ethanol producers with capacity of no more than 40 million gallons per year. No one facility would be allowed more than 20 million bushels.	Reduces Federal costs for storing CCC grains & helps expand ethanol industry. However, would cut demand for corn from private suppliers.
Daschle (S. 219) *Dorgan (H.R. 254)* *Simon (S. 1304)* *Mitchell (S. 1351)* *Alexander (H.R. 2031)* *Waxman (H.R. 3054)* *Durbin (H.R. 2052)*	Proposals range from nonbinding resolutions expressing sense of both House & Senate with respect to use of ethanol, methanol, & other oxygenated fuels as an accepted air pollution-control strategy, to bills which mandate gasoline blended with ethanol. Example: One proposal requires that half of motor fuels sold by U.S. refiners be blended with 10% ethanol by 1992.	Not clear that ethanol industry could expand quickly enough to meet upper limits of some blending requirements. Additional ethanol demand would increase corn demand & prices. Increased use of ethanol would reduce carbon monoxide but could contribute to ozone problems.
Pesticides		
Federal Insecticide, Fungicide, & Rodenticide Act & related issues		
Proposed changes		
Oberstar (H.R. 3174) *Durenberger (S. 1419)*	Determines which pesticides are likely to leach into groundwater. Sets an action trigger at low, health-based contamination level.	Specific pesticide use would be sharply curtailed if chemical residue were detected in groundwater. Sets low groundwater residue levels.

Policy/proposal	Key provisions	Comments
Pesticides, *continued*		
Bustamante (H.R. 963) *Moynihan (S. 20)*	Establishes State & Federal network for assessing & addressing groundwater contamination problems. States set standards based on EPA's list of contaminants	Provides interdependent Federal & State approach to preventing groundwater contamination.
de la Garza (H.R. 2463) *Leahy (S. 1516)*	Comprehensive revision of FIFRA, provides for a) EPA reregistration of 600 active ingredients used in 50,000 pesticide products; b) fee schedule to be paid by chemical manufacturer to EPA to cover costs of reregistration process; c) evaluation of inert ingredients for possible adverse effects; d) public right-to-know; chemical producers would have to make publicly available product fact sheets of health, safety, & environmental data; e) expedited product cancellation procedure; f) EPA would immediately suspend product originally registered with false or invalid data; g) label precautions required in the U.S. also required on labels of exported pesticides; h) commercial pesticide applicators required to receive formal training; i) States would be given primary enforcement in investigating misuse complaints; j) EPA would have to report to Congress the costs of indemnification for suspended chemicals; k) regulations governing pesticides in groundwater would be tightened	Both users & manufacturers of agricultural pesticides would be affected by a hastening of the rate at which pesticides are considered for registration, reregistration, or cancellation. Proposed revisions would make pesticide use safer by strengthening the provisions under which these chemicals are registered, marketed, & used.
Coleman (H.R. 463)	Amends FIFRA to improve notification of local, State, & Federal officials when suspended or cancelled pesticides are stored nearby & to provide for discretionary inspection of storage facilities by EPA.	Insures that suspended & cancelled pesticides are handled safely. Makes location of pesticide storage facilities public knowledge. Insures against long-term storage of a cancelled pesticide in containers meant for short-term retail use
Wyden (H.R. 711)	Requires Food & Drug Administration to seize & destroy imported food found to be in violation of U.S. health standards for pesticide residue levels.	
Boucher (H.R. 1345)	Extends patent term from 17 to 22 years for EPA-registered pesticides. Other amendments to FIFRA range from allowing abbreviated product registration applications by generic chemical manufacturers to allowing Federal agencies wishing to use pesticides on public lands access to EPA data.	Allows patent holders an extended marketing period to recoup time lost during EPA registration process. Excludes generic industry from protected markets for additional 5 years.
Endangered Species Act of 1973		
Current law	Authorizes EPA to prohibit or restrict use of pesticides which jeopardize endangered species or their habitats.	EPA has identified 600 counties in 40 States where labeling to restrict use would apply
Proposed changes		
Studds (H.R. 1467) *Mitchell (S. 675)*	Reauthorizes Endangered Species Act (ESA) of 1973 through 1992. Increases fines for violation. Extends protection to endangered plant species.	An opposing bill is proposed (Karnes: S. 1844, & Roberts: H.R. 3477) which would prohibit EPA from implementing pesticide restriction under ESA.

Alternative Agriculture Gains Attention

A new term is heard on and off the farm. It is "alternative agriculture," also known as "sustainable," "regenerative," "organic," or "low-input" agriculture. This article compares alternative and conventional agriculture. It looks at why and how alternatives to conventional agriculture are gaining attention, what will affect their adoption, and what changes they might bring.

Alternative and Conventional Agriculture Compared

The "alternative" approach.—Alternative agriculture is another way of thinking about agriculture and its links with people and their environment. Sustainable, regenerative, organic, and low-input alternatives emphasize different ends and means. But all share the goal of an agriculture that produces an abundance of safe and nutritious food that is sustainable both economically and physically, and that has positive effects, or at least minimum adverse effects, on human health, natural resources, environmental quality, and rural communities. Conventional agriculture at times falls short of these goals.

Coventional agriculture is described in a recent memorandum by the Secretary of Agriculture as a system that is highly specialized and emphasizes high yields achieved by inputs of fertilizers, pesticides, and other off-farm purchases. Alternative farming systems, according to the memorandum, range from systems with only slightly reduced use of these inputs through soil tests, integrated pest management, and capital inputs, to systems that seek to minimize the use through appropriate rotations, integration of livestock with crops, mechanical/biological weed control, and less costly buildings and equipment.

Alternative agriculture addresses multiple objectives such as increasing profits and maintaining the environment. And it may incorporate and build on multiple systems and practices such as integrated pest management and soil conservation.

Most people think of alternative agriculture as different ways of producing traditional crops. It can also include alternative farm enterprises and non-farm services, from new crops and livestock products to aquaculture.

The conventional approach.—Conventional agriculture is a way of thinking, too. It emphasizes making a living from farming, and is characterized by capital-intensive monoculture, continuous cropping, and a substantial reliance on manufactured inputs and extensive use of credit.

Conventional "agri-culture" stresses *production*. It says "more is better." Economists know that the most profitable output on a farm is usually something less than maximum physical output—that at some point dollar returns from higher increments of output may not cover additional costs. But this is all too easily forgotten, even by economists.

The development and expansion of conventional agriculture were made possible and profitable by relatively low-priced petrochemicals, ample credit, suitable infrastructure, and the availability of research-based information and education assistance from land grant colleges and USDA. Farm price and income support policies, tax preferences for agriculture, and other public programs all have helped conventional agriculture.

Different treatment of resources and environmental quality.—Conventional agriculture does not ignore resource conservation or environmental quality. However, it tends to treat them as constraints on profit maximization. Take soil conservation. Traditionally, it has played second to production. If farmers see erosion cutting yields or incomes, then they adopt conservation measures. When conservation is socially desirable but not profitable for the farmer, the Government has provided financial and technical assistance.

Under alternative agriculture, farmers look for complementarities between conservation and production. Rotations can serve both goals. Average annual soil erosion from land planted to corn in one year, but to hay or a legume crop the previous year, is less than the erosion from the same land used to grow corn continuously. Rotations generate nutrients and can help control pests. Alternative agriculture consciously searches for complementarities, whereas conventional agriculture may treat unintended consequences as side effects.

For many farmers, conservation tillage has saved soil without sacrificing farm income. And yet, it may require increased use of herbicides. In such cases, a reduction in soil erosion has come at the cost of potential groundwater and surface water contamination. Proponents of conventional agriculture tend to cite conservation tillage as a victory and the herbicide problem as an unwanted but inevitable side effect. Proponents of alternative agriculture look for ways to increase conservation without more herbicides.

Why and How Has Alternative Agriculture Gained Attention?

U.S. farmers have been acclaimed the most productive in the world. Crop yields, livestock production, and the number of people reportedly fed by one farmer have risen dramatically in recent decades. And as the 1980's began, exports of farm products were making an enormous contribution to the U.S. balance of payments. Conventional agriculture was a growing source of national pride.

But the price of this success was high: soil erosion with substantial off-site damages, as well as higher fertilization to offset erosion-based yield losses; contamination of surface and groundwater from pesticides and fertilizer; soil compaction due to use of heavier and larger machinery; depletion of groundwater supplies and salinity problems resulting from irrigation; and the loss of fish and wildlife or their habitats due to chemical runoff and conversion of forests, range, and wetlands to crops. Some of these problems have recently come to light as a result of media attention, and of our increasing ability to classify and measure them.

Conventional agriculture's image peaked in the late 1970's as farmers planted fencerow to fencerow in response to growing exports. But the image tarnished in the early 1980's, as exports, commodity prices, and land prices turned down, causing severe financial stress to farming.

Consumer interests and concerns also changed. Use of pesticides and other chemicals caused consumers to worry about food safety. If conventional agriculture excelled at producing abundant food at reasonable prices, it sometimes seemed to do so at the expense of food and environmental quality.

These problems opened the door to alternative agriculture, and alternative agriculture is maturing as it responds. Until recently, if the term alternative agriculture were used at all, it probably meant organic farming, which was criticized as an unrealistic answer to the problems of conventional agriculture. Indeed, early proponents of organic farming appeared to set their sights on ending the use of chemicals without regard to profits.

But supporters of conventional agriculture who chided organic enthusiasts for being too emotional, and for even thinking that lower yields and wormy apples might be desirable, were just as emotional. To them, widespread adoption of organic farming in periods of strong demand for food promised shortages and, ultimately, posed the question, "how will we decide who is to starve?"

Most of the emotionalism that once surfaced at the mention of organic farming has now waned. Many farmers are reducing purchased pesticides and fertilizer not because of allegiance to organic or alternative agriculture, but to cut production costs. Farmers are more concerned with the environmental and health hazards conventional agriculture poses. Their own families and neighbors can be affected by contamination of farm wells. They are discouraged by the growing resistance of weeds and insects to pesticides. Some may regard restrictions on the use of agricultural chemicals as inevitable and are shifting to alternative views.

Awareness of the importance of profits has grown among supporters of alternative agriculture. The idealism of organic farming has been tempered by the realization that an ecologically benign agriculture is sustainable in the long run only if it is profitable in the short run.

One version of alternative agriculture is called low-input agriculture. To most people this means reduced use of manufactured or purchased inputs, not a cutback in total input use. The approach usually involves the substitution of more management and labor for fewer pesticides and fertilizers.

Farmers see low-input agriculture as a way to reduce costs, maintain or increase income, and minimize debts. Substituting rotations and livestock enterprises for off-farm nutrient sources generally reduces on-farm and off-site damages caused by soil erosion, and protects wildlife habitats. Cultivation and other practices instead of chemical weed control, and biological pest management instead of chemical insecticides, help meet the goals of an environmentally benign agriculture.

What Will Affect Adoption of Alternative Agriculture?

Let's look at some of the conditions and trends that could affect farmers' decisions to adopt alternative agriculture.

Commodity and input prices.—Rising foreign demand for farm commodities could intensify conventional production on a larger acreage. A rise in energy prices, in contrast, would encourage alternative agriculture by reducing the profitability of conventional pesticide and fertilizer use.

Farm and environmental policies.—Commodity programs encourage conventional specialization and intensification in crops considered erosive. Base acreage provisions could penalize farmers for shifting to rotations by reducing the eligible program acreage. Program payments tied to historical yields deter adoption of alternative agriculture when it is accompanied initially by lower yields.

Environmental protection policies tend to favor alternative farming approaches. Under the Conservation Reserve Program initiated in the 1985 Food Security Act, some 23 million acres have been taken out of erosive crop production and placed under permanent grass or trees. The reserve supports resource conservation, a goal shared by alternative agriculture.

Infrastructure and markets.—Wide adoption of alternative approaches could require changes in infrastructure and in input and product markets. New markets might be required for nutrients not now being bought or sold. New marketing channels would be needed so farmers could benefit from premium prices for organically-grown or pesticide-free foods.

Expansion of alternative agriculture may require new information and services on everything from weather to marketing options. Past experience with integrated pest management (IPM) illustrates the point. To use IPM, farmers need not only more and better weather information, but also insect scouting services.

Transition costs.—Shifting from conventional to alternative agriculture involves some indirect costs to farmers. The transition may involve a drop in yields and lower revenue for several years, despite reduced production costs. Farmers who cannot accept the risk of an initial income reduction will hesitate, or perhaps convert part of the farm at a time.

Alternative agriculture is not a return to older and simpler methods; it calls for even more information and more sophisticated management as substitutes for other inputs, particularly agricultural chemicals.

Adoption could be slower on farms with limited management and labor, and with substantial, remunerative off-farm employment. Some farmers may be reluctant to increase their dependence on labor (whose uncertain supply in the past explained farmers' shifting to mechanical-chemical inputs). Farmers more likely to adopt alternative agriculture are those who have access to reliable labor and opportunities to hire skilled management if necessary.

Adoption of alternative approaches might be slowed by heavy investments in machinery, buildings, and other fixed assets. Farmers who would incur financial losses when terminating the use of such assets may delay conversion.

Research and education.—Research and extension education have been major factors behind the expansion of conventional agriculture, but this is changing. The land grant colleges and USDA have begun to expand alternative agriculture programs. Until recently, farmers did most of the

research and experimentation on alternative agriculture, sharing results through informal networks, publications, and field days.

Alternative or sustainable agriculture centers, institutes, and foundations are popping up at land grant colleges in Iowa, Wisconsin, California, and other States. A growing number of colleges have established alternative agriculture chairs and courses.

The 1988 agricultural appropriation includes $3.9 million for research and education on low-input farming, under a provision in the 1985 Food Security Act (Agricultural Productivity Research under the Research and Education Title). Appropriation of any new Federal money, given the current budget deficits, signals unusual Congressional interest and support.

The program will be administered by USDA's Cooperative State Research Service with help from agricultural experiment stations and extension leaders in each region, a USDA interagency Research and Education subcommittee, and non-Government organizations. The funds will be used mainly for innovative research and extension projects at regional and State levels to help farmers identify and adopt low-input approaches.

These developments should not be expected to bear fruit overnight. Given the scope and complexities of alternative agriculture, expansion of research and education will take time. We know far too little about the relative profitability of alternative farming approaches. Information about which farms have shifted to alternative agriculture, and with what results, has been mostly anecdotal.

Changes Are Gradual But Far-Reaching

Current developments do not indicate a wholesale departure from conventional agriculture, but rather a growing diversity of farming systems. Future agriculture likely will put more emphasis on conservation, environmental quality, human health, and food quality than did the conventional agriculture of recent decades.

Adoption requires skilled management. Medium-sized farms might well be among those most likely to have, acquire, or hire the management and labor required by alternative approaches. This could change the bimodal trend toward larger and smaller farms. Contrary to the view that alternative agriculture is small-scale farming, operators of smaller farms with off-farm employment might have the least incentive to convert.

If many crop farms diversify into livestock, changes would be expected in livestock production and marketing, as well as feed production and distribution. But these changes need not be dramatic because alternative ways of producing crops need not require livestock. Plant nutrients can come from legumes, purchased manure, and other natural sources. However, the most efficient way to market hay and other rotation crops on many farms could be through livestock.

The diversification of crops, livestock, and other enterprises could have significant impacts on prices of farm products and the economic viability of rural areas. While the diversity could run counter to the economic benefits of specialization, it might reduce the accompanying risks. That is, it could dampen the price-depressing effects of a large number of farmers responding to unfavorable markets for a dominant commodity by switching to the same alternative commodity. Prices, and profits, could become less volatile.

Changes in rural economies would occur as farmers shift to new crops and to recreation or other enterprises. Nonfarm rural economic activities would be affected if more farmers turn full-time to alternative agriculture, curtailing their off-farm employment. These possibilities point to a growing need for research and education on the links between alternative farming approaches, food and fiber markets, the environment, and rural communities, and how each might be affected by significant adoption of alternatives to conventional agriculture. *[Neill Schaller (202) 786-3313]*

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